REMARKS

Claims 2-10, 12 - 16, and 20 - 29 remain in the application. Claims 24 – 29 are newly added but do not add any new matter.

In accordance with the prior phone conference with the Examiner on August 29, 2007, Applicant has amended Claim 8 to include features suggested by the Examiner such as a start point, an end point, and a direction of travel for the glass tube.

The present invention results from the discovery that by heating and lowering an arc tube through a furnace towards a mandrel perpendicular to an exit of the mandrel and by utilizing chucks to supply tension to the arc tube during formation, the arc tube can be formed with less defects. (Pg. 5, ln. 20 – Pg. 8, ln. 16). The present invention is in a highly competitive industry of manufacturing double spiral glass tubes that can form arc tubes in, for example, a fluorescent lamp. As can be appreciated, the relatively high cost of energy and the necessity to conserve natural resources has created a greater demand for compact fluorescent tubes that can replace the wasteful incandescent light bulbs. However, there are numerous major international companies which are involved in providing such products using numerous highly skilled scientists and engineers. Since the industry is so competitive, consumers can demand the latest features of the product. Thus, any technological improvement, no matter how minor, could be the crucial difference between commercial success or commercial failure.

> Thus when differences that may appear technologically minor nonetheless have a practical impact, particularly in a crowded field, the decision-maker must consider the obviousness of the new structure in this light.

Continental Can Co. USA Inc. v. Monsanto Co., 20 U.S.P.Q. 2d. 1746, 1752 (Fed. Cir. 1991).

The present invention enables a highly compact lamp that can provide at least the same luminous flux of conventional arc tubes with a lamp efficiency improvement of 13% and a rated life improvement of approximately 10%. (Pg. 45, ln. 25 – Pg. 46, ln. 19). Additionally, the significant problem of defective tubes that, in the past, have sometimes reached a fail rate of 50% has now been addressed by the present invention and a trial, instigated to simulate mass production, resulted in an increase of usable product with a resulting yield of 98.9%. (Pg. 41, lns. 1 – 16).

The present invention utilizes predetermined lengths of straight glass tubes 160 with the end portions of such tubes supported by chucks 197 and 198 while heating a central portion 163 of glass tube 160 to a temperature above the softening heat range of glass tube 160. For example, for a glass tube of a characteristic of softening in a temperature range of 670-690°C, a central portion can be heated within a furnace to a temperature of about 770°C. Central portion 163 of glass tube 160 is not supported and can sag under its gravity weight as shown, for example, in Figures 8A - 8C. (Pg. 19, ln. 15 – Pg. 24, ln. 14).

A mandrel 180 is mounted perpendicularly beneath an exit of tunnel 173 of the furnace 170 and aligned with the positioning of glass tube 160 such that mandrel 180 can capture a central portion 163 that is sagging as shown in Figures 10A - 10C. The end portions of the glass tube can be held within chucks 197 and 198 and the chucks can be aligned so that the straight portion matches the helical angle of the winding mandrel 180. (Pg. 24, ln. 24 – Pg. 26, ln. 17).

Additionally, chucks 197 and 198 can restrain the movement of the end portions 161 and 162 to provide an appropriate range of tension to ensure that the tube diameter of the sagging portion is maintained at a consistent size. That is, it is neither increased, which has been a problem in the prior art, nor is it decreased. Thus, the relative ratio of the moving speed of the

chucks relative to the rotational speed of the mandrel can be held within an appropriate range. This can vary depending on the specific dimensions or diameter of the glass tube. (Pg. 35, ln. 7 – Pg. Pg. 31, ln. 17). Furthermore, the mandrel itself can be heated to facilitate the formation of the arc tube through the intermediate sagging portion and appropriate gas pressure can also be applied.

The Office Action rejected Claims 2-10, 12-16, and 20-23 under 35 U.S.C. § 103(a) as being unpatentable over *Greiner* (U.S. 2,491,857) in view of *Holzer* (DE 198 55 240).

Greiner heats a glass tube 2 in oven 1 using rollers 4 and 5. It then ejects glass tube 2 onto chute 40 where it rolls down an inclined plane onto form 3. By spinning and raising form 3, glass tube 2 can be coiled.

Holzer is directed towards the creation of glass spirals with special ends which do not require the glass tube 11 to be re-heated after it is wound into a spiral to remove the glass tube 11 from the winding thorn 1. It accomplishes this by using a winding thorn that rotates upwards to create a spiral in glass tube 11. By not having to re-heat glass tube 11 to remove glass tube 11 from the spiral, *Holzer* conserves energy while allowing ends 7 of glass tube 11 to be pressed by pliers 9.

With respect to Claim 8, the Office Action admits that *Greiner* does not teach or suggest "a holding step of holding ends of the glass tube by movable chuck units" and "a softening step of softening the glass tube held by the chuck units by applying heat to the glass tube in a heating furnace." However, *Holzer* also does not teach or suggest "a holding step of holding ends of the glass tube by movable chuck units" or "a softening step of softening the glass tube held by the chuck units by applying heat to the glass tube in a heating furnace." The Office Action states using "chuck units" attached to the ends of the glass tube are "deemed to be merely trivial

extensions over the Holzer disclosure." As noted by the Office Action, *Holzer* does not actually depict "chuck units" in Figures 1 – 4a. *Holzer* furthermore does not discuss the use of chuck units at all. It only mentions that in Figure 2, glass tube11 is heated up and the ductile glass tube 11 is put between the drivers 2 and into bent editions 3. The glass tube positioning is depicted in broken lines. There is no teaching as to how exactly glass tube 11 is positioned onto drivers 2 and into bent editions 3 or how it should be held when it is heated. That is *Holzer* teaches that those functions should be done, but does not teach the means nor the components that should be used such as chuck units. The only depictions and discussions of chuck units occur in the Office Action on page 8 where the Office Action annotates a copy of Figure 2 with the Office Action's language. The Office Action surmises that chuck units are used in *Holzer* without any teaching by *Holzer* to do so.

However, as the specification of the present invention notes, the prior art suffered problems when chuck units were not used such as glass tubes having diameters that are too small, the glass tubes having been improperly wound, or the glass tubes being deformed. (Pg. 4, lns. 19 – 24).

The chuck units in the present invention reduce the likelihood of defects within the arc tube when the arc tube is being placed on the mandrel. The movements of chuck units 197 and 198 are controlled in stages to prevent sudden or excessive tension loads from acting on the double spiral scheduled portion Ga of the glass tube 160 as seen in Figures 10a, 10b, 10c, and 11A. This reduces the likelihood that glass tube 160 will have a smaller tube diameter at the double spiral scheduled portion Ga. (Pg. 28, ln. 16 – Pg. 31, ln. 17).

Furthermore, in the winding step, when mandrel 180 has already started to rotate, chuck units 197 and 198 will not have started move yet as shown in Figure 14. This allows a tension

load to act on the glass tube 160 in the lengthwise direction which prevents the loosening of glass tube 160 which had tended to occur in the prior art. If the glass tube is loosened it could become deformed. (Pg. 35, lns. 12 – 21).

Thus, in contrast to the Office Action's assertions that the chuck units are merely trivial extensions of *Holzer*, the chuck units in the present invention aid in reducing the deformities that may occur in the glass tube during the creation of a fluorescent light bulb.

Neither *Greiner* nor *Holzer* recite "a moving step of moving the glass tube being in a soft state substantially perpendicularly downward from an exit of the heating furnace to the mandrel positioned below the exit of the heating furnace." As can be seen in Figure 2, tray 3 is not below oven 1 but instead is to the left of oven 1. Thus, tray 3 is not positioned below an exit of oven 1.

Also, there is no indication that *Holzer* aligns the winding thorn below a heating furnace as the heating furnace is not actually depicted in the Figures and there is no teaching in the specification of *Holzer* as to the positional relationship between the heating furnace and the winding thorn.

In contrast, in the present invention, as seen in Figures 7B and 8a – 8c, mandrel 180 is positioned below an exit of tunnel 173 of heating furnace 170 and the axis D of mandrel 180 extends substantially perpendicularly from the exit of tunnel 173. (Pg. 25, lns. 2 – 9) By aligning the mandrel 180 with the exit of tunnel 173, the direction of sagging of glass tube 160 matches the direction in which glass tube 160 is moved. This reduced the swaying in the front-and-back direction of glass tube 160 which was a problem in the conventional manufacturing method. Thus, it is easier to place glass tube 160 on the top 181 of mandrel 180. (Pg. 24, lns. 10 – 14).

Furthermore, the Office Action admits that *Greiner* does not disclose "a hanging and holding step of hanging and holding the moved glass tube being in a soft state on a top of the mandrel positioned below the heating furnace." However, *Holzer* also does not teach "a hanging and holding step of hanging and holding the moved glass tube being in a soft state on a top of the mandrel positioned below the heating furnace." *Holzer* depicts a bent glass tube and the Office Action interprets that to mean that it is hanged and held. However, there is no indication that the glass tube is being hanged and held while it is in a soft state. *Holzer* merely teaches that glass tube 11 is bent prior to being placed on winding thorn 1 and that glass tube 11 can be further bent when it is placed on winding thorn 1. *Holzer* does not teach that the glass tube sags under gravity. The glass tube could be heated and then bent through a variety of methods aside from gravity. Furthermore, there is no indication that the glass tube is actually in a soft state when it is placed on top of winding thorn 1. Glass tube 11 could be in a hardened state and then softened after it is placed on top of winding thorn 1.

Furthermore, since *Holzer* does not depict the furnace and its positional relationship with the winding thorn 1, there is no teaching in *Holzer* that the glass tube is moved while it is in a soft state on top of the winding thorn 1 positioned below the heating furnace. Thus it is possible that *Holzer* uses a system like the prior art depicted in Figure 2 of the present invention where the glass tube 900 is heated in a furnace 910 and then moved in a horizontal direction towards a mandrel 920. When viewed in a lateral direction this could be similar to Figure 2. This is problematic because there could be swaying of the glass tube 900 as it is being transported and it will also be difficult to align it with the top of mandrel 920. This could cause deformities with the glass tube. (Pg. 4, ln. 19 – Pg. 5 ln. 15; Pg. 24, lns. 10 – 14).

With respect to Claim 20, neither *Greiner* nor *Holzer* teach or suggest "lowering the heated glass tube until the sagging intermediate portion engages the mandrel with grooves representative of the double spiral configuration, the mandrel being disposed beneath the heating furnace and the sagging intermediate portion of the glass tube." The Office Action admits that Greiner does not teach the features of the present invention. However, *Holzer* also does not teach the features of the present invention. As can be seen in *Holzer*, it appears that the whole glass tube 11 is bent as opposed to only having an intermediate portion of the tube sagging as recited in the claim language of the present invention.

Also, there is no indication in *Holzer* that the glass tube is being hanged and held while it is in a soft state. *Holzer* merely teaches that glass tube 11 is bent prior to being placed on winding thorn 1 and that glass tube 11 can be further bent when it is placed on winding thorn 1. In addition, since *Holzer* does not depict the furnace and its positional relationship with the winding thorn 1, there is no teaching in *Holzer* that the glass tube is moved while it is in a soft state on top of the winding thorn 1 positioned below the heating furnace. This could cause deformities with the glass tube. (Pg. 4, ln. 19 – Pg. 5 ln. 15; Pg. 24, lns. 10 – 14).

With respect to Claim 29, neither *Greiner* nor *Holzer* teach or suggest "means for heating and softening the glass tube such that an unsupported central portion of the glass tube is substantially linear when the glass tube traverses a substantially horizontal direction, and the unsupported central portion of the glass tube is in a soft state sagging in a gravitational direction due to a gravitational force while the ends of the glass tube remain substantially linear when the glass tube traverses a substantially vertical direction prior to the glass tube exiting an exit of the means for heating and softening the glass tube."

Holzer does depict how the glass tube 11 is heated and thus does not teach the features of the present invention.

Greiner also does not teach the features of the present invention. In *Greiner*, glass tubing 2 is supported by rollers 4 and 5 oven 1 as seen in Figure 2. Thus, there is no portion of glass tubing 2 which is unsupported while glass tubing 2 is in oven 1. Furthermore, there is no indication that a central portion of glass tube 2 starts to sag due to a gravitational force while in oven 1 or that it sags when traversing in a vertical direction.

In contrast, in the present invention, straight glass tube 160 is supported at its ends by chucks 197 and 198 while the central portion remains unsupported as it traverses through furnace 170. The straight glass tube 160 moves in the X direction from the entrance of tunnel 173 of the heating furnace 170, and glass tube 160 does not reach the softening point while it is moving in the X direction. However, as glass tube 160 starts traveling in the Y direction, glass tube 160 gets close to the softening point and at some point in the travel of the Y direction, glass tube 160 reaches the softening point and starts to sag prior to exiting heating furnace 170. (Pg. 20, ln. 19 – Pg. 22, ln. 10; Fig. 8a – Fig. 9B).

The MPEP §2182 states that "application of a prior art reference to a means or step plus function limitation requires that the prior art element perform the identical function specified in the claim. However, if a prior art reference teaches identity of function to that specified in a claim, then…an examiner carries the initial burden of proof for showing that the prior art structure or step is the same as or equivalent to the structure, material, or acts described in the specification which has been identified as corresponding to the claimed means or step plus function." The "means or step plus function" limitation should be interpreted in a manner

consistent with the specification disclosure. See *In re Donaldson Co.,* 16 F.3d 1189, 29 USPQ2d 1845 (Fed. Cir. 1994).

Furthermore, neither *Greiner* nor *Holzer* disclose "means for moving the glass tube while the unsupported central portion of the glass tube is in the soft state in the gravitational direction from the exit of the means for heating and softening the glass tube to a mandrel located beneath the exit of the means for heating and softening the glass tube and positioned in alignment with the gravitational direction."

Holzer does not disclose the location of the mandrel and thus does not teach moving the glass tube while in its soft state to the mandrel from the furnace. Furthermore there is no indication in *Holzer* that it actually moves the glass tube while it is in the soft state.

In *Greiner*, form 3 is located to the left of oven 1 and is not located in alignment with the sagging of the glass tube while the glass tube is in the oven. This is especially true considering that the glass tube in *Greiner* does not sag while it is in the oven.

In contrast, in the present invention, glass tube 160 is moved while the central portion is still in a soft state from an exit of heating furnace 170 directly towards mandrel 180 which is aligned with a direction of the sagging of glass tube 160. (Pg. 24, lns. 8 – 14; Pg. 25, lns. 2 – 9; Figs. 8a – 8c).

Also, neither *Greiner* nor *Holzer* disclose means for providing a tension load on the glass tube through the ends of the glass tube when the mandrel starts to rotate.

There is no indication that *Holzer* provides a tension load on the glass tube. Greiner also does not provide a tension load on the glass tube. In Greiner, belts 105 and 106 pushes glass tube 2 towards form 3 to bring the ends towards engagement with pressing roles 75 and 76. Thus it pushes rather than pulls glass tube 2 and thus does not create tension force.

In contrast, in the present invention, when glass tube 160 starts to be wound about the mandrel 180, chuck units 197 and 98 have not started move yet, as shown in Figure 14. Because of this arrangement, a tension load acts on the glass tube 160 in the lengthwise direction which inhibits the loosening of glass tube 160. (Pg. 35, lns. 12 – 21; Fig. 14).

Claims 2-7, 9-10, 12 – 16, and 21 – 28 depend from and further define Claims 8 and 20 and are thus allowable, too.

If the Examiner believes a telephone interview would help further the prosecution of this case he is respectfully requested to contact the undersigned attorney at the below listed number.

Very truly yours,

SNELL & WILMER L.L.P.

Edward Y. Lin
Registration No. 58,567
600 Anton Boulevard, Suite 1400
Costa Mesa, California 92626-7689
Telephone: (714) 427-7508
Facsimile: (714) 427-7799